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FEB 27 2003  
TECHNOLOGY CENTER R3700

CLEAN VERSION OF NEW CLAIMS

11. A catheter system for removing embolic material from a vessel comprising:

a fluid supply catheter having a catheter body, said catheter body having a distal tip, said fluid supply catheter having a fluid supply lumen and having at least one distal aperture for injecting fluid into said vessel;

said fluid supply lumen receiving fluid at a first supply rate;

said distal aperture directing fluid so that a component of flow flows retrograde;

a sheath having a distal tip and having an internal lumen for exhausting fluid and debris from said vessel, said sheath having an outside diameter to fit within said vessel partially occluding blood flow but not totally occluding blood flow;

said fluid supply catheter located within said sheath and adapted for motion with respect to said sheath;

whereby said catheter body can be moved independently of said sheath distal tip.

12. A catheter system according to claim 11 wherein said internal diameter of said sheath is larger than the maximum diameter of said catheter.

13. A catheter system according to claim 11 wherein said internal diameter of said sheath is substantially equal to the maximum diameter of said catheter.

14. A catheter comprising:

a catheter body having a proximal end and having a distal end;

said catheter body defining an axis;

said distal end having an approximately circular cross section;

a fluid injection lumen in said catheter body terminating near the distal end, for connection to a device for injecting fluid at a first rate;

one or more apertures at the distal end of the catheter body, connecting the fluid supply lumen with the exterior surface of said catheter body;

said aperture defining at least one aperture direction for the emerging flow that lies between approximate ninety degrees and zero degrees, as measured from an axis along the catheter body, where zero degrees corresponds to a directly retrograde flow and ninety degrees corresponds to lateral ejection from the catheter body;

said aperture cooperating with said catheter body to direct a flow of fluid emerging from said aperture along said catheter body such that fluid flows in a retrograde direction from said distal end toward said proximal end.

19. The catheter of claim 14 further including :

a control body surface located immediate adjacent said aperture, providing a barrier located proximate said aperture, for limiting fluid entrainment from the location of said control body, near the aperture by the jet emerging from the aperture, whereby said jet is deflected by a pressure difference across said barrier.

21. The catheter device of claim 19 wherein a tangent drawn to said control body surface at the location of the aperture is parallel to the aperture direction.

22. The catheter device of claim 19 wherein a tangent drawn to said control body surface at the location of the aperture forms an included angle with the aperture direction that is greater than zero degrees and less than ninety degrees.

23. A extraction catheter system for removing embolic material from a vessel having a vessel diameter, said system comprising:

a sheath having a sheath lumen adapted to receive and guide a catheter, said sheath lacking an occlusion device but having an exterior diameter sized to fit in said vessel partially occluding but not totally occluding said vessel;

said catheter having a catheter body having a distal end and a proximal end and having an interior and an exterior surface;

a fluid supply lumen in said catheter body, for connection to a device for injecting fluid at a first rate;

a fluid port connecting said fluid supply lumen with the exterior surface of said catheter body;

said fluid port and said body cooperating to attach fluid ejected from said fluid port to said body;

whereby said fluid ejected by said port mixes with embolic material and follows the catheter body in a retrograde direction, transporting the fluid and embolic material into said sheath lumen where it is collected at a second rate.

24. The catheter system of claim 23 wherein said catheter distal end is located within said sheath lumen.

25. The catheter system of claim 23 wherein said catheter distal end is located outside said sheath lumen.

26. A method of using a catheter system to remove material in a vessel comprising:

advancing a sheath having a sheath lumen to a location near material to be removed,  
said sheath partially but not totally occluding said vessel;

advancing a catheter of the type having a fluid port to eject fluid thus creating a  
retrograde flow, through said sheath lumen to a location near material to be removed;

injecting fluid into said catheter causing fluid to emerge from the catheter,  
entraining material located near said catheter;

removing said fluid and entrained flow from said sheath lumen.